A SIMPLE SMART HOME BASED ON IOT USING NODEMCU AND BLYNK

Compiled as one of the requirements of completing the undergraduate program at the department of Electrical Engineering Faculty

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Abstrak

Internet of Things (IoT) menghubungkan perangkat dan alat ke jaringan internet untuk dikendalikan oleh situs web dan aplikasi smart phone dari jarak jauh, juga, untuk mengontrol alat dan instrumen dengan kode dan struktur algoritma untuk masalah kecerdasan buatan. Jika diinginkan sistem canggih menggunakan algoritma python, maka WiFi atau Ethernet dihubungkan ke alat, peralatan, dan perangkat yang dikendalikan dengan aplikasi smart phone atau situs web internet. Itulah definisi sederhana IoT. Lebih jauh dari sekadar menggunakan IoT sebagai smart home untuk mengoperasikan lampu atau perangkat rumah tangga lainnya, dapat juga digunakan sebagai sistem keamanan atau sistem aplikasi industri, misalnya, untuk membuka atau menutup gerbang gedung utama, untuk mengoperasikan mesin industri otomatis, atau bahkan untuk mengontrol internet dan port komunikasi. Juga lebih banyak ide dapat dilakukan menggunakan teknologi IoT. Fasilitas industri besar atau lembaga pemerintah memiliki banyak lampu. Karyawan terkadang lupa mematikan di penghujung hari. Penelitian ini menyarankan solusi yang dapat menghemat energi untuk membantu keamanan mengontrol pencahayaan gedung dengan rumah pintar menggunakan aplikasi Blynk. Lampu dapat dikendalikan oleh sakelar yang tersebar di gedung bersama aplikasi Blynk dengan instalasi listrik tertentu. Penelitian ini menghadirkan prototipe sederhana rumah pintar, atau cara mudah dan biaya rendah untuk mengontrol beban melalui koneksi Wi-Fi secara umum.

Kata Kunci: Blynk, Ethernet, IoT, Wi-Fi.

Abstract

The internet of things (IoT) is connecting the devices and tools to the internet network to be controlled by websites and smart phone applications remotely, also, to control tools and instruments by codes and algorithms structures for artificial intelligence issues. In case we want to create advanced systems using python algorithms, Wi-Fi or Ethernet connection is connected to our tools, equipment, and devices controlling them by smart phone applications or internet websites. That's actually the simplified definition of IoT. Farther than just using the IoT as a smart home to operate lamps or other home-use devices, it can be used as a security system or an industrial-use system, for example, to open or close the main building gate, to operate full automatic industrial machine, or even to control internet and communication ports. And more ideas can be done by using IoT technology. A huge industrial facilities or governmental institutions have much of lamps. Employees sometimes forget to turn them off in the end of the day. This research suggests a solution that can save energy by letting the security to control lighting of the building with his smart home by Blynk application. The lamps can be controlled by switches distributed in the building and Blynk application at the same time with a certain electrical installation. This research presents a simple prototype of smart home, or the easy way and low cost to control loads by Wi-Fi connection generally.

Keywords: Blynk, Ethernet, IoT, Wi-Fi.

1. INTRODUCTION

A load controlled by computer systems has many advantages compared with manual controlled loads. Nowadays there are many programs and applications help to control things better using codes or python algorithms in artificial intelligence projects. In order to save energy and make loads monitored easily, this research suggests smart home project based on IoT technology. This smart home is an Internet of Things (IoT) project that controls loads with internet connection via Wireless Fidelity WIFI connection. A smart phone connected to internet with Blynk application as a control panel, and NodeMCU microcontroller kit in other side as a controller that receives control commands via WIFI signal. NodeMCU kit is built with ESP8266 WIFI receiver that able to process and analyze WIFI signal to input the microcontroller. The WIFI receiver and microcontroller are built in one kit to be used as IoT project. It's called NodeMCU.

To connect the system to the Internet, needs a WiFi receiver. In my case I used ESP8266 that is connected as built-in in the NodeMCU board that contains a firmware runs with the ESP8266. The firmware is a low-level control computer software.

The NodeMCU is coded via Arduino Integrated Development Environment (IDE) with the Universal Serial Bus port (USB) to tell the NodeMCU what to do, I want to make the NodeMCU controls four-channel relay kit by Blynk hand phone application and shows the temperature that measured by LM35 sensor.

Parts used to create the project:

1) NodeMCU board. Open source internet of things platform.
2) AC-DC step down converter. Switch mode power supply to provide the project with power. This project needs 5 volts.
3) DC-DC step down converter as a regulator to convert the 12 V output of the power supply into regulated 5 V.
4) Four-channel relay kit. To drive loads from digital NodeMCU output pins.
5) LM35 temperature sensor. To measure room temperature.
6) Computer with Arduino (IDE) program installed to code the NodeMCU once.
7) Android smart phone with Blynk application installed to be used as control panel.

2. METHOD

This research is conducted based on the important steps that are done by orienting on the success indicators in connecting the NodeMCU ESP8266 module and other devices so that it can be used to solve multi-objective problems. To achieve these indicators, the stages of this research are as follows:

1) Analysis of the problem. Analyze the problems to be studied regarding smart home.
2) Analysis of needs. In this case all needs in researching both from journals, literature books, tools, and materials.
3) System design. Designing tools to be built using the NodeMCU ESP8266 module, and the sensors used.
4) System programming. Make a program using the Arduino IDE and the Blynk android application.
5) Testing tools. Testing tools with program codes created and internet connections.
6) Making reports and summarizing the results of the experiment. See system responsiveness to commands given to smart home.

2.1 The Flow of The System

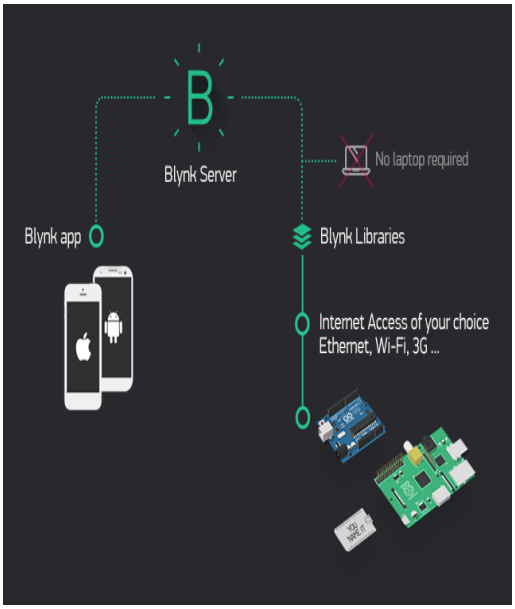
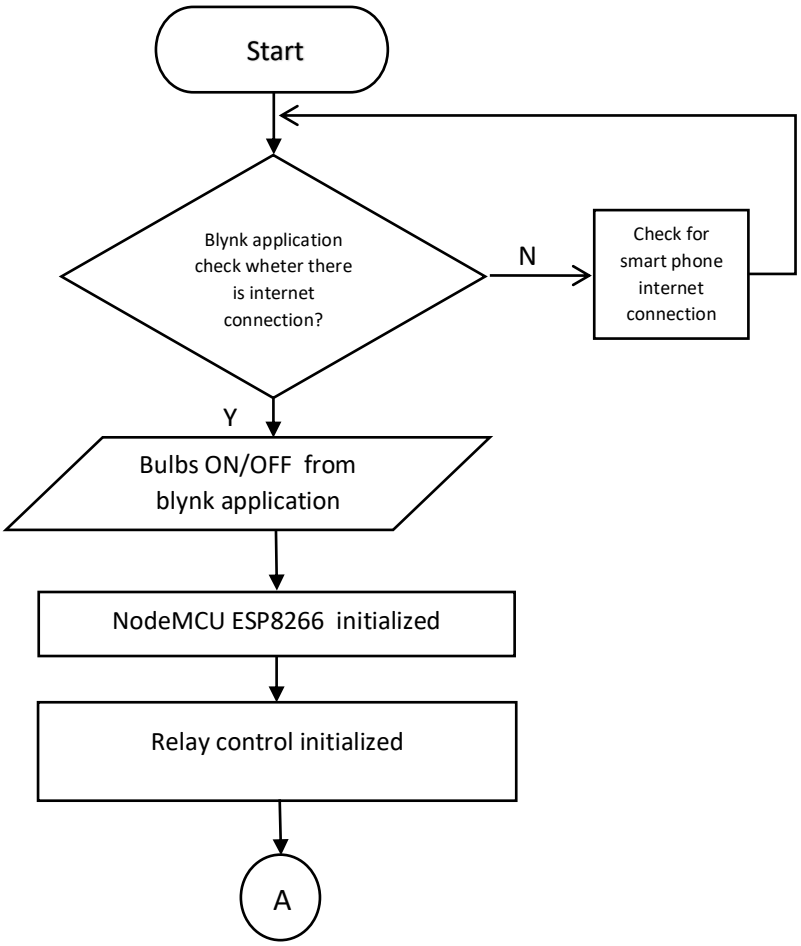


Figure 1. Blynk System Principle

The system is based on NodeMCU board as an internet of things system. The NodeMCU is connected to the internet from the hotspot of the smart phone via WIFI connection as the NodeMCU has ESP8266 circuit to connect with the internet.

NodeMCU to be connected to the hotspot of the smart phone, needs to be identified to the name of hotspot, the password and token code letting the server of Blynk connects them together. You may need the computer once to transfer code from Arduino IDE to the NodeMCU kit to prepare the software part of the project. Figure 1 shows that the server of Blynk application will process the smartphone-NodeMCU connection. Blynk libraries are ZIP files can be downloaded from Github website to be imported to the Arduino IDE library.

Blynk server will check for internet connection, NodeMCU with android hotspot, the NodeMCU code includes the token code, the name of hotspot and it's password. The information included to the code must be match with the hotspot information to allow ESP8266 connect with the WIFI to be as a channel to exchange commands between smart phone and NodeMCU. Remaining processes are just commands sent from Blynk application to NodeMCU to control loads those are connected to the relay kit as shown in Figure 2. And sensor output value is sent reverse to the Blynk application from NodeMCU kit.



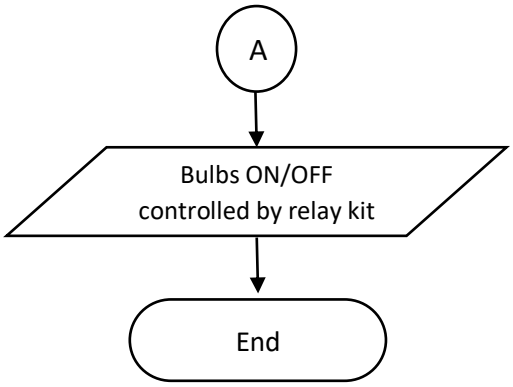


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Figure 2. Flowchart of Load ON/OFF

To show the temperature value in Celsius degrees on the android display, NodeMCU will send sensor output value in voltage to the Blynk application back. Like the ON/OFF process last flowchart, Blynk server will check for internet connection and hotspot name and password, the sensor output value to show the temperature correctly. The temperature is showed by gauge tool in the Blynk application after setting the input pin and temperature scale as shown in Figure 3**.**

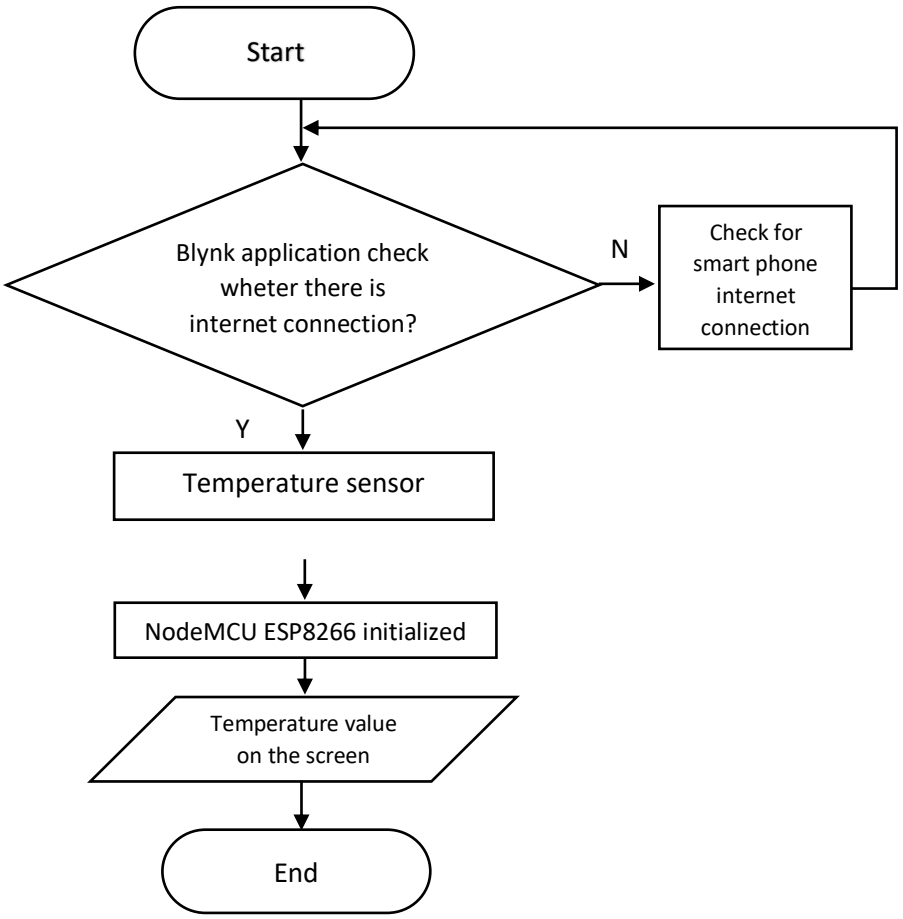


Figure 3. Flowchart of Temperature Sense

2.2 The Block Diagram of the System

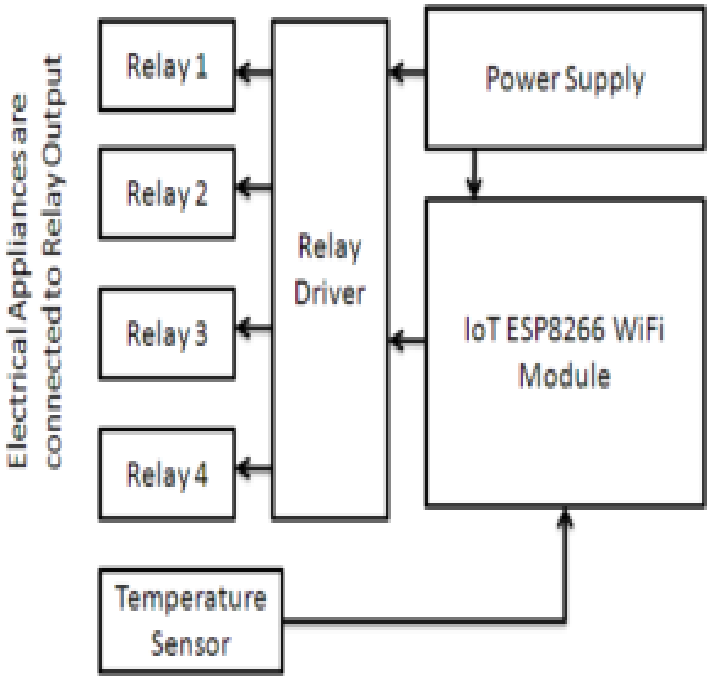


Figure 4. System Block Diagram

Figure 4 shows the system block diagram. The Power Supply will provide energy to the system through the relay and NodeMCU ESP8266 modules, so that all equipment can work and function properly. NodeMCU ESP8266 microcontroller will read the temperature by the Temperature sensor LM35, and then send the data to the Blynk server in TCP / IP format for display on the smart phone. NodeMCU ESP8266 microcontroller will also read commands that have been sent by the Blynk Server in TCP / IP format which will then be changed by giving the logic "HIGH" or "LOW" on certain pins by relay to regulate the on / off of the home lights. Cloud (internet) by utilizing Wi-Fi becomes the central connection between Blynk application and NodeMCU project.

2.3 Blynk application and Arduino IDE Preparation and Running

This project is running by Blynk application. Down load the application to a smart phone from Google play store and then create a project on it with four switches and one gauge to be as a temperature scale. Set buttons to be switches on D1, D2, D3 and D4. Then set gauge on A0 because the sensor output is on A0 in NodeMCU board. Figure 5 shows screenshots from Blynk application

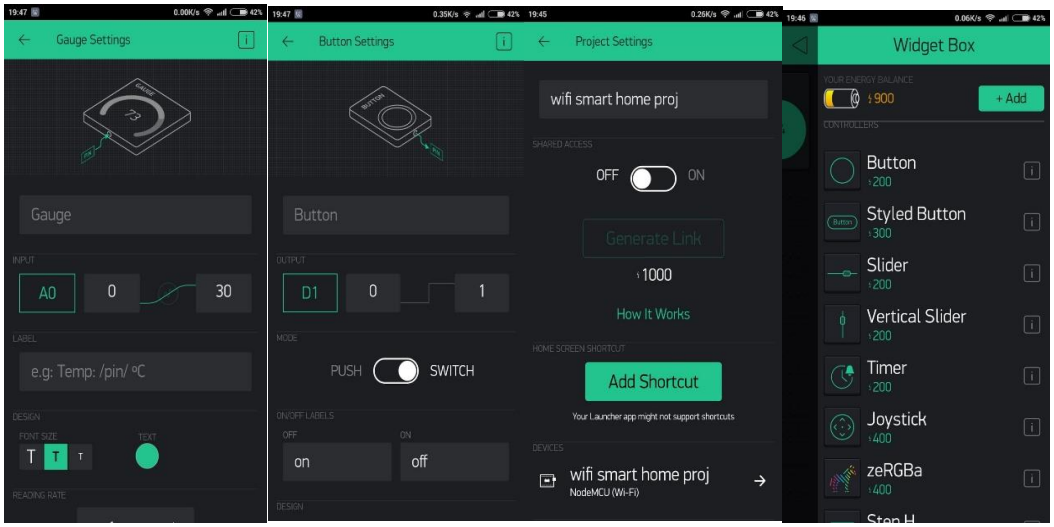


Figure 5. Screenshots from Blynk Application

2.4 NodeMCU Code via Arduino IDE

To code NodeMCU via Arduino IDE, the NodeMCU needs to be added to Arduino IDE library first by adding this address to Arduino IDE preferences. After this reference is added to Arduino IDE, download nodeMCU to boards manager and then select NodeMCU 1.0 (ESP-12E Module). After nodeMCU is added to Arduino IDE library, upload this code with changing hotspot name and password also token code. Shown in figure 6.

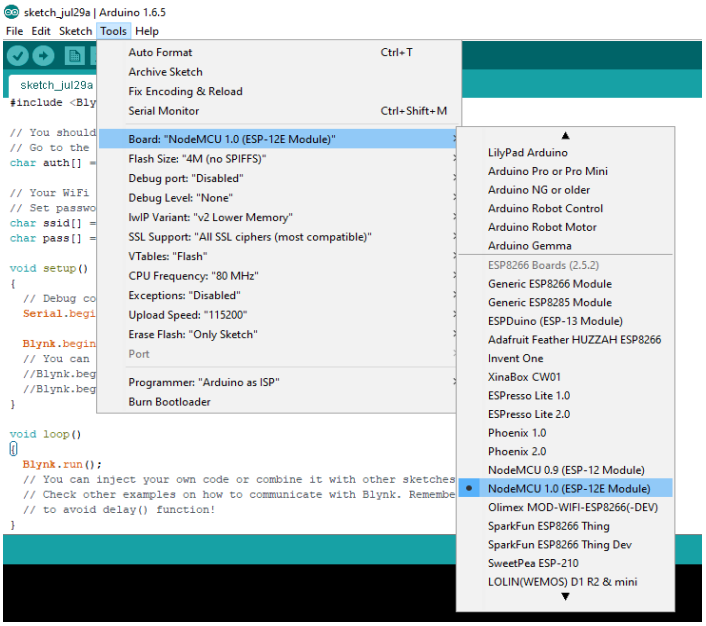


Figure 6. Setting up NodeMCU in Arduino IDE

Figure 7 shows the NodeMCU code. The code includes the hotspot name and password match with the android. The code does not need to identify the relay input, as it is included in

[Blynk.run();]. When auth (autho token) is given by Blynk application sent as email and SSID is the name of smart phone hotspot.

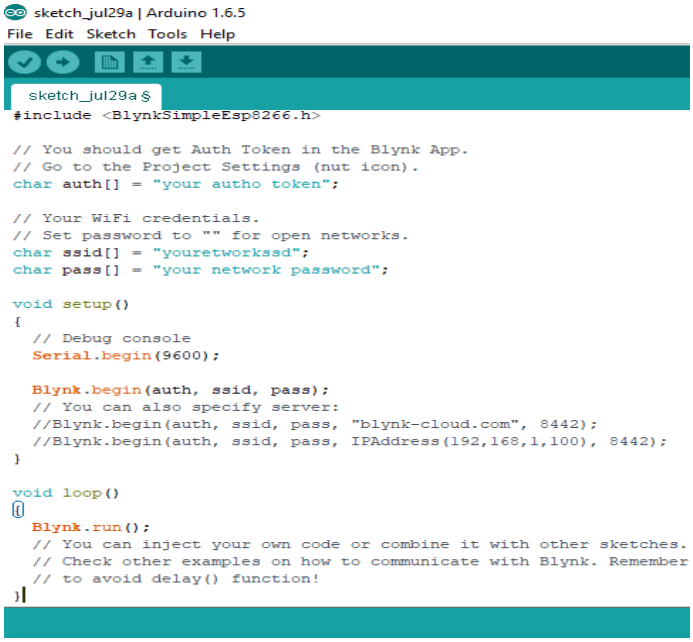


Figure 7. NodeMCU Code

2.5 The Hardware of the System

As mentioned above, components used to build the circuit, NodeMCU needs 5VDC as a supply voltage Vin pin, AC-DC step down converter 12V and DC-DC step down converter 5V, in case using AC-DC step down converter 5V, no need to use DC-DC converter. Output voltage of the power supply is connected to Vin NodeMCU, Vcc of relay kit and VCC of LM35 temperature sensor. When the ground is common. D1,D2,D3 and D4 are outputs and A0 is an analog signal input is connected to the temperature sensor as shown in Figure 8. Using Fritzing software to draw and simulate the circuit as shown in Figure 9.

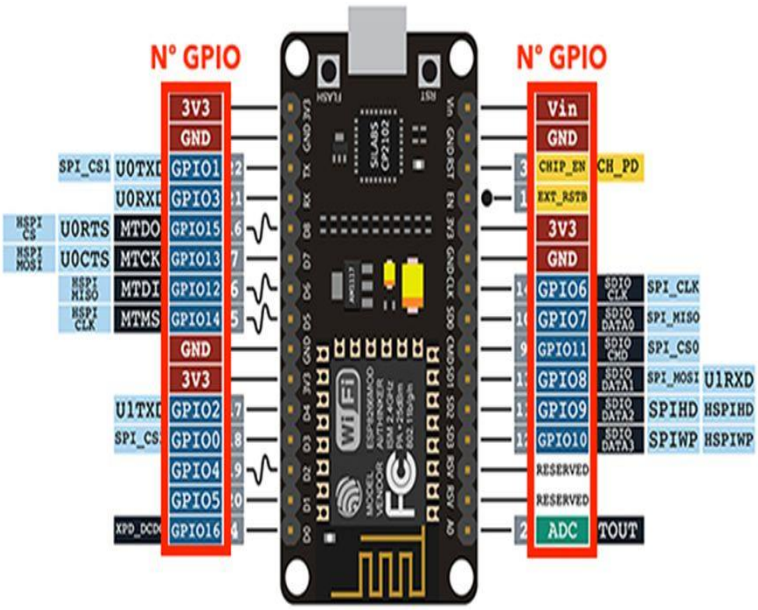


Figure 8. NodeMCU Pinout

Pins used:

1) Vin is connected to power supply output 5VDC.
2) GND is ground.
3) D1,D2,D3 and D4 are used as digital outputs.
4) A0 is used as analog signal input to input sensor signal.

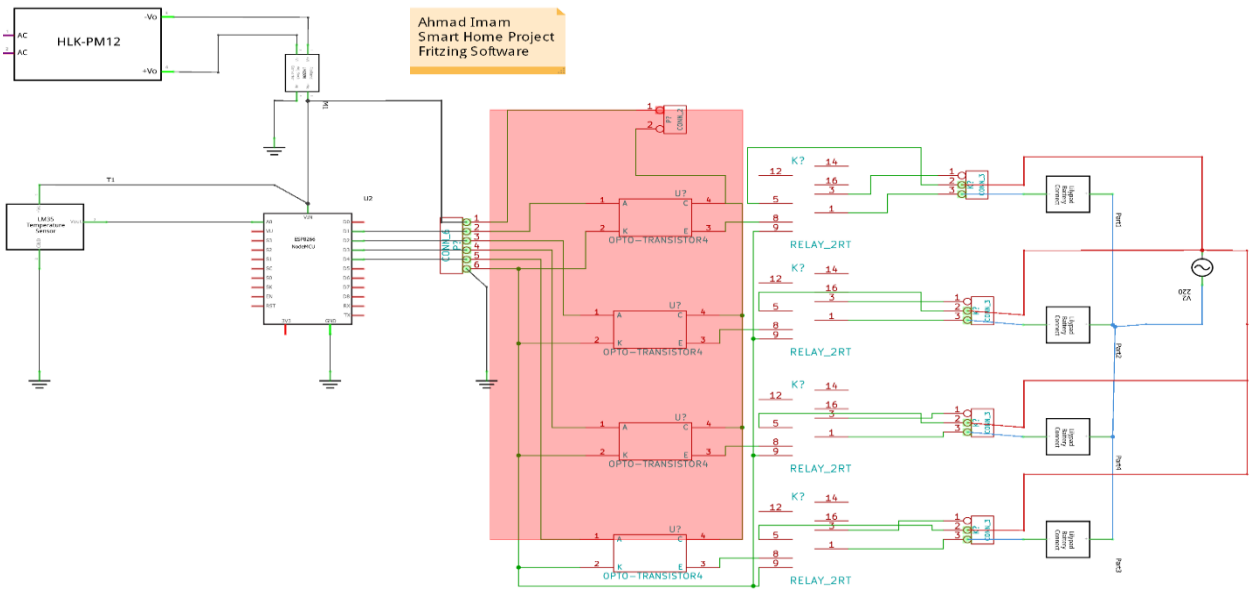


Figure 9. The Circuit Diagram

2.5.1 Relay Module

As shown in figure 10, relay module is being connected directly to digital circuits including microcontroller kits easily to control big loads by a microcontroller. The inputs IN1, IN2, IN3 and IN4 operate four relays with voltage between 3-5 volts DC. Input and output circuits are separated by Optocouplers to protect digital circuits in case connection mistakes happened or short circuits.

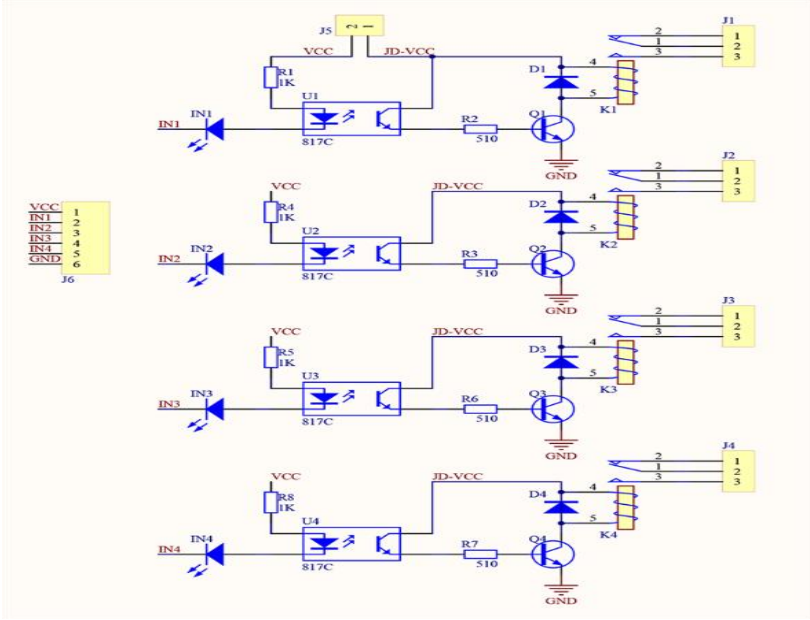


Figure 10. Relay Module Circuit Diagram

2.5.2 LM35 Temperature Sensor

LM35 is an integrated circuit that works in range 4-20V DC as a temperature sensor with a precision at 10m V for one Celsius degree and low output impedance about 0.1 ohm at 1m A. LM35 is built in TO-92 package with three pins

1) Vcc
2) output
3) ground

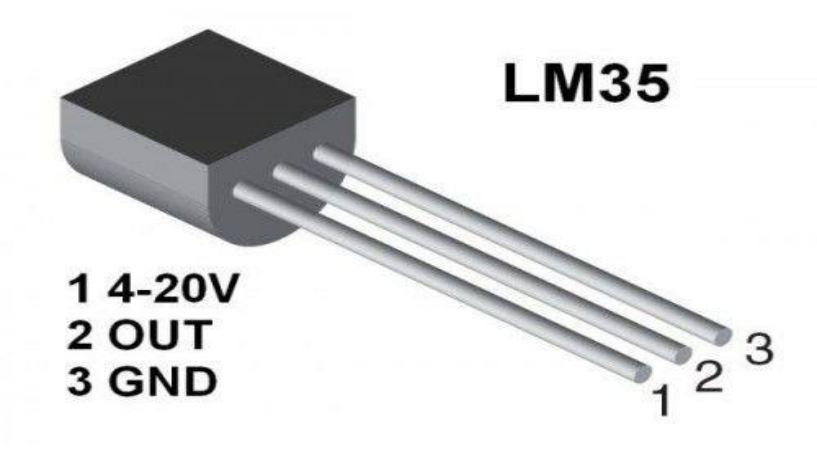


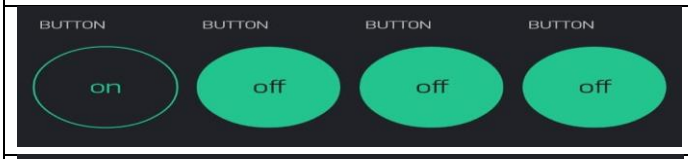
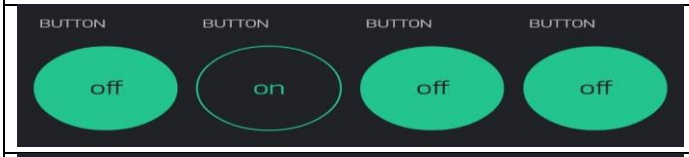
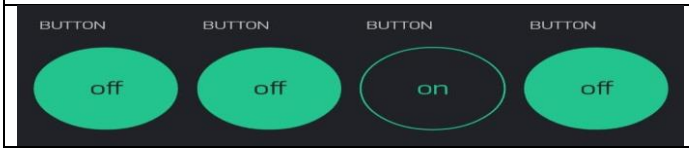
Figure 11. LM35 Pinout

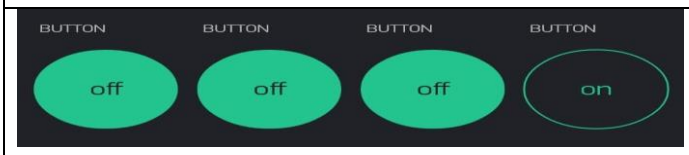
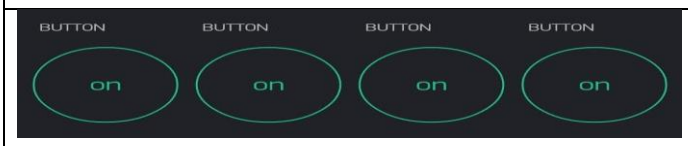
3. RESULTS AND DISCUSSION

3.1 Light Control Test Results

The Light Control Test is done by pressing the ON / OFF button widget on the Blynk application on the respective Android smart phone for lights and fans. This is done after the system is turned on and connected to a Wi-Fi internet connection. If at any time the internet connection is lost or bad signal, then it also affects system performance. Table 1 shows switches test results.

Table 1. Light Control Test

Switch status	On	Off
	----	Relay 1 Relay 2 Relay 3 Relay 4
	Relay 1	Relay 2 Relay 3 Relay 4
	Relay 2	Relay 1 Relay 3 Relay 4
	Relay 3	Relay 1 Relay 2

		Relay 4
	Relay 4	Relay 1 Relay 2 Relay 3
	Relay 1 Relay 2 Relay 3 Relay 4	----

3.2 LM35 Sensor Test

LM35 Sensor Testing is done by recording the temperature changes that occur every minute. This is done after the system is turned on and connected to a Wi-Fi internet connection. If at any time the internet connection is disconnected or bad signal, then it also affects system performance.

Table 2. Temperature Test

Minute	Temperature
1	32
2	33
3	33
4	34
5	33
6	32
7	33
8	34
9	33
10	33

3.3 System Analysis

From testing the entire system above, the smart home works according to what is the purpose of this research. Comparison of this research with previous studies, namely this study uses temperature sensor and control buttons, thus increasing the diversity of the smart home system itself. Also, used a microcontroller that is different from previous studies that is the NodeMCU ESP8266 module which has advantages compared to other microcontrollers. The smart home has been successfully built with hardware arranged in such a way that it can achieve results that are as expected. In this case the hardware that plays a very important role as the main device is the NodeMCU ESP8266 module. The advantages of using the NodeMCU ESP8266 are more practical than buying various components and then assembling them by yourself.

3.4 The Final Hardware Circuit Connection

Using components and materials mentioned above. Figure 12 shows the project that's used as an (IoT) system controlled by Blynk application is running. Loads used in this project are bulbs, they can be changed with other devices by changing bulbs with AC plugs to connect home-use devices or equipment.

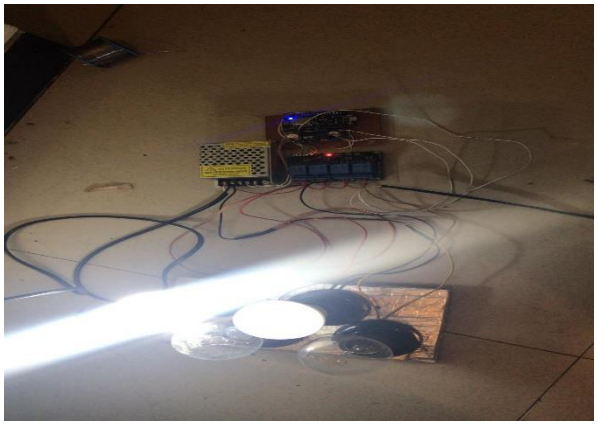


Figure 12. Project Test

4. CLOSING

4.1 Conclusion

Based on the results of analysis of all data obtained by testing the smart home with the Internet of Things based NodeMCU ESP6288 module, the following conclusions can be drawn:

1) Smart Home with Internet of Things (IoT) based NodeMCU ESP8266 Module can be designed with various components hardware and software support so that it can be arranged into a smart home system that is controlled with the Blynk android application according to what is intended.
2) The Smart Home with this Internet of Things (IoT) based NodeMCU ESP8266 Module can be implemented to control some of the home electronics performance including lighting controls, fan control, temperature monitoring, early warning systems and etc.

4.2 Suggestions

In the design and manufacture of this final project there are still deficiencies that need to be corrected in order to perfect this final project, including:

1) Optimizing the power control consumption of the NodeMCU ESP8266 module to be further developed in wireless-based technology application, considering the current technology prioritizes low cost but efficient.
2) The development of an internet-based smart home system of things needs to be tested on other electronic devices in everyday life.

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